

REMARKS

The Office Action of October 18, 2007 has been received and the Examiner's comments carefully considered. Claims 39 and 40 have been amended to address the alleged lack of proper antecedent basis for certain of the terms therein. Claim 41 has been added by this Amendment. Support for claim 41 is replete throughout the specification, such as on page 9 of the specification as filed. Thus, no new matter has been added by this Amendment. Accordingly, claims 22-41 are currently pending in this application.

In the Office Action, claims 39 and 40 stand rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Specifically, it is alleged that the limitation "the control valve" in claim 39 and "an additional cooling medium channel" in claim 40 lack a proper antecedent basis. Applicants thank the Examiner for her suggestions in overcoming these rejections. Claim 39 has now been amended to adopt the suggestion of the Examiner, namely amending the claim so that it depends on claim 38 instead of claim 22. Because claim 38 contains an antecedent basis for the limitation "the control valve," this amendment is sufficient to overcome the outstanding rejection of claim 39 under 35 U.S.C. § 112, second paragraph. Claim 40 has now been amended by removing the word "additional". This amendment is sufficient to overcome the rejection of this claim under 35 U.S.C. § 112, second paragraph. Consequently, each of claims 22-41 is now in a condition for allowance.

Additionally, in the Office Action, claims 22-32 and 35-40 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over European Publication No. 0 913 357 A1 to Abe (hereinafter "Abe") in view of United States Patent Application Publication No. 2003/004431 to DeBellis et al. (hereinafter "DeBellis"). Claims 33 and 34 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Abe and DeBellis in further view of United States Patent Application Publication No. 2002/0000067 to Numata et al. (hereinafter "Numata"). Each of these rejections is respectfully traversed.

The current invention is directed to a device for generating hydrogen comprising a heated steam reformation stage with a reformer catalyst for converting gaseous or vaporizable hydrocarbons and water into hydrogen, carbon monoxide, and other reformation products. The steam reformation stage is embodied as a hollow body with a shell chamber. The shell chamber is embodied as an annular chamber which can house a reformer catalyst. A heating device is arranged in the shell chamber. The device further contains at

least one stage downstream of the reformation stage for catalytic conversion of the mixture emanating from the reformation stage. These conversion stages are embodied as a hollow body with an annular chamber that can house a catalyst. The current invention also contains a purification stage that is downstream of the conversion stage(s). The purification stage is for catalytic reduction of the residual carbon monoxide and is embodied as a hollow body with an annular chamber for housing a catalyst. The annular chamber of the purification stage directly connects with the annular chamber of the conversion stage and the annular chamber of the conversion stage directly connects to the annular chamber of the reformation stage so as to form a complete annular chamber that runs throughout the device.

Abe is directed to a reformer device. The device includes a heating unit and several catalytic units arranged in series. The catalytic units are capable of generating hydrogen from a reactant which contains organic compounds. The catalysts include a catalyst for steam reforming reaction, a catalyst for CO shift reaction, and a catalyst for CO selective oxidation reaction. The heating unit and the catalysts are disposed in a metallic casing, which is generally a hollow tube. The reactant is fed into and flows throughout the entire cross section of the tube before exiting at the opposite end of the tube. Abe fails to teach, suggest, or disclose a series of catalytic stages where the catalysts are housed in annular chambers.

DeBellis is directed to an annular heat-exchange reactor vessel that allows for the controlled heat transfer between two fluids flowing through the vessel. The reactor vessel of DeBellis includes a central, hollow tube and two multi-channeled annular flow regions around the central tube. A plurality of fins extend throughout the annular flow regions. These fins are optionally coated with catalyst materials that promote combustion reactions. The heat from the combustion reactions, which occur within the annular space, is transferred via the fins to a fluid flowing within the central tube. This process heats the fluid within the central tube. DeBellis does not disclose the particular series of reactions recited by Applicants or disclose the use of a heating device. In fact, DeBellis teaches away from the inclusion of a heating device because the heating in DeBellis is done solely through the heat transferred from the combustion reactions within the annular chambers.

In the Office Action it is alleged that one skilled in the art would find it obvious to modify the teachings of Abe to include annular channel structures as in DeBellis since DeBellis teaches that such structures increase mixing and add additional structural

support. However, Abe and DeBellis, whether considered alone or in combination, simply do not render obvious a device like that recited by Applicants in claim 22. As mentioned above, Abe does not disclose annular flow chambers. DeBellis, while disclosing annular chambers, does not discuss the reaction stages in series in conjunction with a heating device. DeBellis is instead primarily concerned with the heat transfer between two fluids where one fluid is flowing in an annular chamber. In addition, DeBellis does not contemplate a heating device and even teaches away from using a heating device in conjunction with the heat-exchange design described therein.

Despite these fundamental differences between the applied art and the invention recited in claim 22, it is alleged that one skilled in the art would find it obvious to select and combine certain elements from Abe and DeBellis in order to create Applicants' invention since DeBellis allegedly teaches that annular chambers increase mixing and provide additional structural support. This rationale, however, is simply insufficient to establish a *prima facie* case of obviousness in view of the fundamental differences between Applicants' invention and the applied art discussed above. First, DeBellis does not in fact teach that the annular chambers themselves provide structural support and improve mixing, but only that the fin structures within the annular chambers do so. (DeBellis, [0076]-[0077]). Further, Applicants' invention is not based on a need for additional structural support or better mixing of the reactant, but is instead, at least in part, based on Applicants' observation that devices like in Abe, where gas is free to flow across a large cross-sectional area, create a radial temperature drop that detrimentally affects the consistency of the reaction products, as explained in the specification on pages 5 and 6.

Claims 33 and 34 stand rejected over Abe and DeBellis, as applied to claim 22, in further view of Numata. Numata is cited in the Office Action only as allegedly teaching that one skilled in the art would find it obvious to equip a SelOx stage with an air supply and that this air supply could be embodied as an annular manifold with distributed discharge nozzles. However, Numata does not teach an annular chamber design, much less the use of such a design in conjunction with a separate heating device and thus does not cure the deficiencies of Abe and DeBellis previously discussed.

Newly added claim 41 further defines the instant invention by reciting that no separate feed or discharge lines or bypass devices are necessary between the individual stages. This claim corresponds to a claim recently allowed by the European Patent Office in

a European patent application based upon the same underlying PCT application (EP 1 427 668 B1). This limitation further distinguishes the claimed invention from the applied art. For instance, Figure 7 of DeBellis, alleged in the Office Action as teaching annular catalytic chambers, discloses a bypass line between the stage represented by reference numeral 220 and the stage 240.

CONCLUSION

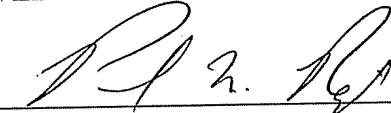
For all of the foregoing reasons, Applicants submit that pending claims 22-41 are patentable over the cited documents and are in condition for allowance. Accordingly, reconsideration of the rejections and allowance of pending claims 22-41 are respectfully requested.

Should the Examiner have any questions regarding any of the foregoing, or wish to discuss this application in further detail to advance prosecution, the Examiner is invited to contact Applicants' undersigned representative at the telephone number provided below.

Respectfully submitted,

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